

**REMARKS**

Claims 1 and 3-6 are pending in the present application. Claims 1 and 5 are herein amended. Claim 2 has been cancelled. The specification is herein amended at page 13, lines 7-20. No new matter was added.

Support for the amendment to claim 1 may be found in the specification as originally filed, for example original claim 2 and on page 8, lines 21-23 and page 13, lines 7-20.

Support for the amendment to claim 5 may be found in the specification as originally filed, for example on page 15, lines 1-3.

The specification, page 13, was amended for clarity. Support for the amendment to specification, page 13, lines 7-16, may be found in the specification as originally filed, for example, page 18, lines 2-10.

Support for the amendment to the specification, page 13, lines 17-20, may be found in the specification as originally filed, for example, page 13, lines 7-16.

**Specification Objection**

The disclosure was objected to as allegedly being informal. Applicants respectfully traverse the objection.

The currently presented specification is not required to recite the PCT application on the first line of the disclosure. As stated in the MPEP§1893.03(c) III, note, “it is not necessary for the applicant to amend the first sentence(s) of the specification to reference the international application number that was used to identify the application during international processing of the application by the international authorities prior to commencement of the national stage.”

Favorable reconsideration is earnestly solicited.

**Claim Rejection Under 35 U.S.C §112**

Claim 5 was rejected under 35 U.S.C. §112, second paragraph, as allegedly being indefinite. Applicants respectfully traverse the rejection.

Claim 5 is drawn to the bubbles. It is a product claim. It is permissible to have claims of different classes of subject matter depending from one another. See for example, MPEP §871.04. Applicants respectfully hold the position that since claim 5 is drawn to bubbles, it does not have to include a further method step.

**Claim Rejection Under 35 U.S.C §102(b)**

Claims 1 and 4-6 were rejected under 35 U.S.C. §102(b) as allegedly being clearly anticipated by Ivanovich et al. (U.S. 6,572,084).

The method of the currently presented invention can reliably produce highly monodisperse bubbles. It can provide microfine monodisperse bubble, wherein the bubble diameter size is in the nanometer range, i.e, monodisperse nanobubbles.

In claim 1, since the gas is pressurized into the liquid at the claimed operating condition (e.g. the pressure) according to the characteristics of the liquid and the porous body used, monodisperse bubbles having a smaller average bubble diameter can be obtained, as can be seen in the as originally filed specification, for example on page 13, lines 7-20.

In Example 1 of the present patent application specification, the presently claimed method achieves monodisperse bubbles having an average bubble diameter of 750nm with a  $\Delta P$  of 3.0 MPa. See Applicants' specification, page 17, lines 15-17.

In Example 1, the  $P_c$ , minimum pressure, based on Figure 5, is about 2.3 MPa.  $\Delta P$  is not less than the  $P_c$  and is in the range of 0.2-10 MPa.

The presently claimed invention is able to achieve novel monodisperse bubbles by controlling specific conditions, such as  $\Delta P$  and  $\Delta P_c$ , according to the characteristics of the liquid and the porous body.

However, Ivanovich discloses a homogeneous foam obtained by providing a plate formed with numerous capillary tubes which divide a gas stream into elementary gas components spaced equidistantly from one another upon entering a foaming composition.

Ivanovich does not disclose the control or regulation of the specific condition according to the characteristics of the liquid and the porous body. Ivanovich merely states that “Concentration of the orifices 5, which are uniformly dimensioned to preferably have their diameters varying between 0.02 and 0.16 mm, ranges from 8 to 250 per mm. The gas stream regulated by the valve 13 is supplied to the partition at a rate varying from 0.1 to 5.0 l/min and under pressure lying within a 0.09-15.5 atm interval” (See Ivanovich, Col. 2, line 64-Col. 5, line 2).

Moreover, the diameter of bubbles produced by the method of Ivanovich is 0.125 mm to 0.5 mm. (See Ivanovich, Col. 4, Table).

Thus, Ivanovich does not disclose nanobubbles.

Ivanovich fails to disclose, provide a reason, motivation, description or suggest the presently claimed method and the advantages thereby. Favorable reconsideration is earnestly solicited.

**Claim Rejection Under 35 U.S.C §103(a)**

Claim 2 was rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Ivanovich et al taken in view of Kyrias. (U.S. 3,927,152).

Kyrias discloses a method and an apparatus for bubble shearing, in which nascent bubbles are formed by flowing gas through the very small capillary openings, no larger than about 100 microns in diameter, of a gas diffusing surface into a moving liquid that shears the nascent bubbles off as it moves past the capillary openings.

Kyrias is silent about the claimed condition, the pressure, and the characteristics of the liquid and the porous body used, which is a feature of the presently claimed invention.

Kyrias disclosure in relation to gas pressure is merely

“bubbles 122 are formed at open ends 154 of capillary passages 158, which extend from gas plenum 160 through side walls 146 and 148 of slot 120 (FIG. 12). Each of the upright gas chambers 160 is connected in fluid communication with gas line 124, so that a continuous stream of gas under pressure flows from line 124 through feeder tubes 130 (FIG. 11) to gas plenums 160, and then to open ends 154 of capillary passages 158.” (See Kyrias, Col. 24, lines 56-64).

As well as, “in general, the capillary diameters should preferably be made as small as is practicable without making the gas pressure drop through the capillaries too high’. (See Kyrias, Col. 28, lines 30-32). And finally,

“the gas transmitting capillary passages 158 should also have a minimum LID ratio to minimize backing up by the shearing liquid after a gas bubble has been sheared from capillary opening 154. Backing up of liquid can result in clogging, when the liquid evaporates and precipitates out dissolved salts after the gas again fills the capillary passage. These advantages of a minimum LID ratio for the gas passages must of course be balanced against the disadvantage of any increase in the pressure drop through the passages.”

(See Kyrias, Col. 28, lines 54-63).

In addition, Kyrias merely discloses “gas pressure” in its examples, respectively. (See Kyrias, Cols. 29-35).

In view of these disclosures, Kyrias does not teach, disclose, provide a reason, motivation, description or suggest the relationship between the claimed conditions and the characteristic of

the liquid or the porous body. This is a novel and unobvious embodiment of the presently claimed invention.

The diameter of the bubbles of Kyrias is larger than the bubbles obtained by the presently claimed invention. Kyrias does not teach, provide a reason, disclose or suggest monodisperse nanobubbles.

Kyrias discloses bubbles having the following diameter:

Example 1: 37 $\mu$ m, 39 $\mu$ m

Example 2: 28 $\mu$ m, 43 $\mu$ m

Example 3: 26 $\mu$ m, 25 $\mu$ m

Example 4: 76 $\mu$ m, 98 $\mu$ m

Example 5: 52 $\mu$ m, 40 $\mu$ m

Example 6: 75 $\mu$ m, 100 $\mu$ m

The presently claimed invention achieves an average bubble diameter of 400nm to 900nm.

Thus, Kyrias does not teach, disclose, provide a reason, motivation, description or suggest the method comprising the claimed condition according to the characteristics of the liquid and the porous body and the advantages achieved by the method.

Hence, there is no teaching, disclosure, reasoning, motivation, description or suggestion within Kyrias and Ivanovich of the claimed operating conditions according to the characteristics of the liquid and the porous body and the advantages realized by the method of the presently claimed invention.

The claimed bubbles, having a diameter of 400-900nm, are not taught, disclosed, reasoned or suggested by Kyrias and Ivanovich. Both Kyias and Ivanovich merely disclose bubbles having larger diameter, such as bubbles having a micron order diameter.

Thus, Ivanovich taken in view of Kyrias does not render the presently claimed invention obvious. Favorable reconsideration is earnestly solicited.

**Claim Rejection Under 35 U.S.C §103(a)**

Claim 3 was rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Ivanovich et al taken in view of the admitted prior art. Applicants respectfully traverse the rejection.

As shown above, Ivanovich does not render the presently claimed method unpatentable. The admitted prior art do not overcome the deficiencies of Ivanovich.

Thus, even if the disclosure of Ivanovich and the admitted prior art are combined, Applicants' claimed invention would not have been obvious.

Favorable reconsideration is earnestly solicited.

In view of the above, Applicants respectfully submit that their claimed invention is allowable and ask that the specification objection and the rejection under 35 U.S.C. §102 and the rejections under 35 U.S.C. §103 be reconsidered and withdrawn. Applicants respectfully submit that this case is in condition for allowance and allowance is respectfully solicited.


If any points remain at issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the local exchange number listed below.

Application No.: 10/572,375  
Art Unit: 1797

Amendment under 37 CFR §1.111  
Attorney Docket No.: 062270

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,  
**WESTERMAN, HATTORI, DANIELS & ADRIAN, LLP**

  
Lee C. Wright  
Attorney for Applicants  
Registration No. 41,441  
Telephone: (202) 822-1100  
Facsimile: (202) 822-1111

LCW/BKM/adp